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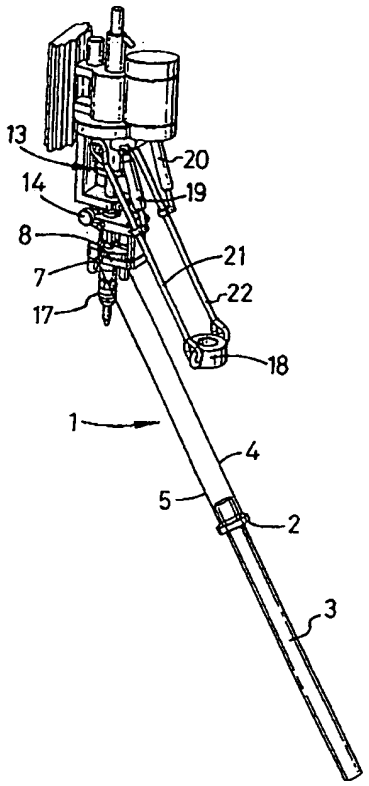
(54) Title: METHOD AND APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE

(57) Abstract

An apparatus for facilitating the connection of tubulars, said apparatus comprising a winch (15), at least one wire line (4, 5) and a device (2) for gripping a tubular (3), the arrangement being such that, in use, the winch (15) can be used to winch said at least one wire (4, 5) and said device (2) to position a tubular (3) below said top drive.



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METHOD AND APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE

This invention relates to a method and apparatus for facilitating the connection of tubulars using a top drive and is, more particularly but not exclusively, for facilitating the connection of a section or stand of casing to a string or casing.

In the construction of wells such as oil or gas wells, it is usually necessary to line predrilled holes with a string of tubulars known as casing. Because of the size of the casing required, sections or stands of say two sections of casing are connected to each other as they are lowered into the well from a platform. The first section or stand of casing is lowered into the well and is usually restrained from falling into the well by a spider located in the platform's floor. Subsequent sections or stands of casing are moved from a rack to the well centre above the spider. The threaded pin of the section or stand of casing to be connected is located over the threaded box of the casing in the well to form a string of casing. The connection is made-up by rotation therebetween.

It is common practice to use a power tong to torque the connection up to a predetermined torque in order to perfect the connection. The power tong is located on the platform, either on rails, or hung from a derrick on a chain. However, it has recently been proposed to use a top drive for making such connection.

Prior to the present invention, pipe handling devices moved pipes to be connected to a tubular string from a rack to the well centre using articulated arms or, more commonly, a pipe elevator suspended from the drilling tower.

The present invention provides an alternative to these devices.

Accordingly, a first aspect of the present invention provides an apparatus for facilitating the connection of tubulars, said apparatus comprising a winch, at least one wire line and a device for gripping a tubular the arrangement being such that, in use, the winch can be used to winch said at least one wire and said device to position a tubular below said top drive.

Further features are set out in Claims 2 to 6.

According to a second aspect of the present invention there is provided a method of facilitating the connection of tubulars using a top drive and comprising the steps of attaching at least one wire to a tubular, the wire depending from the top drive or from a component attached thereto, and winching the wire and the tubular upwards to a position beneath the top drive.

According to a third aspect of the present invention there is provided an apparatus for facilitating the connection of tubulars using a top drive, said apparatus comprising an elevator and a pair of bails, characterised in that said elevator is, in use, movable in relation to said pair of bails.

According to a fourth aspect of the present invention there is provided an apparatus for facilitating the connection of tubulars using a top drive, said apparatus comprising an elevator (102) and a pair of bails (103, 104), characterised in that said elevator (102) is, in use, movable relative to said pair of bails (103, 104).

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:

Figures 1a to 1e are perspective views of an apparatus in accordance with a first embodiment of the present invention at various stages of operation; and

Figures 2a to 2d are perspective views of an apparatus in accordance with a second embodiment of the invention at various stages of operation.

Referring to Figures 1a to 1e there is shown an apparatus which is generally identified by reference numeral 1.

The apparatus 1 comprises a clamp 2 for retaining a tubular 3. The clamp 2 is suspended on wires 4, 5 which are connected thereto on opposing sides thereof. The wire 5 passes through an eye 6 in lug 7 which is attached to a spherical bearing in arm 8 of a suspension unit 9 at the point at which the arm 8 is connected to a hydraulic motor 10. The wire is connected to the hydraulic motor 10 in a corresponding manner. The suspension unit 9 is of a type which enables displacement of the tubular 3 when connected to a tool 17 (see below), relative to a top drive 13, along a number of different axes. The wires 4, 5 pass across the suspension unit 9 and over pulley wheels 11 which are rotatably arranged on a plate 12. The plate 12 is fixed in relation to a top drive generally identified by reference numeral 13. The wires 4, 5 then pass over drums 14 to which the wires 4, 5 are also connected. The drums 14 are rotatable via a hydraulic winch motor 15.

In use, the clamp 2 is placed around a tubular below a box 16 thereof. The hydraulic winch motor 15 is then activated, which lifts the tubular 3 (conveniently from a rack) and towards a tool 17 for gripping the tubular 3 (Fig. 1b). The tubular 3 encompasses the tool 17 at which point the hydraulic winch motor 15 is deactivated (Fig. 1c). During this operation the elevator 18 is held away from the tool 17 by piston and cylinders 19, 20 acting on bails 21 and 22. The suspension unit 9 allows the hydraulic motor 10 and the arrangement depending therebelow to move in vertical and horizontal planes relative to the top drive 13. The eyes 6 in lugs 7 maintain the wires 4

and 5 in line with the tubular 3 during any such movement. The tool 17 may now be used to connect the tubular to the tubular string. More particularly, the tool may be of a type which is inserted into the upper end of the tubular, with gripping elements of the tool being radially displaceable for engagement with the inner wall of the tubular so as to secure the tubular to the tool. Once the tool is secured to the tubular, the hydraulic motor 10 is activated which rotates the tool 17 and hence the tubular 3 for engagement with a tubular string held in a spider.

The clamp 2 is now released from the tubular 3, and the top drive 13 and hence apparatus 1 is now lifted clear of the tubular 3. The elevator 18 is now swung in line with the apparatus 1 by actuation of the piston and cylinders 19 and 20 (Fig. 1d).

The top drive 13 is then lowered, lowering the elevator 18 over the box 16 of the tubular 3. The slips in the elevator 18 are then set to take the weight of the entire tubular string. The top drive is then raised slightly to enable the slips in the spider to be released and the top drive is then lowered to introduce the tubular string into the borehole.

Referring to Figures 2a to 2d there is shown an apparatus which is generally identified by reference numeral 101.

The apparatus 101 comprises an elevator 102 arranged at one end of bails 103, 104. The bails 103, 104 are movably attached to a top drive 105 via axles 106 which are located in eyes 107 in the other end of the bails 103, 104. Piston and cylinders 108, 109 are arranged between the top drive 105 and the bails. One end of the piston and cylinders 108, 109 are movably arranged on axles 110 on the top drive. The other end of the piston and cylinders 108, 109 are movably arranged on axles 111, 112 which are

located in lugs 113, 114 located approximately one-third along the length of the bails 103, 109.

The elevator 102 is provided with pins 115 on either side thereof and projecting therefrom. The pins 115 are located in slots 116 and 116a. A piston 117, 118 and cylinder 119, 120 are arranged in each of the bails 103, 104. The cylinders are arranged in slot 121, 122. The piston 117, 118 are connected at their ends to the pins 115. The cylinders 119, 120 are prevented from moving along the bails 103, 104 by cross members 123 and 124. A hole is provided in each of the cross members to allow the pistons to move therethrough.

In use, a tubular 125 is angled from a rack near to the well centre. The tubular may however remain upright in the rack. The clamp 102 is placed around the tubular below a box 126 (Figure 2a). The top drive is raised on a track on a derrick. The tubular is lifted from the rack and the tubular swings to hang vertically (Figure 2b). The piston and cylinders 108, 109 are actuated, extending the pistons allowing the bails 103, 104 to move to a vertical position. The tubular 125 is now directly beneath a tool 127 for internally gripping and rotating the tubular 125 (Figure 2c). The pistons 117, 118 and cylinders 119, 120 are now actuated. The pins 115 follow slot 116 and the clamp 102 moves upwardly, lifting the tubular 125 over the tool 127 (Figure 2d). The tool 127 can now be actuated to grip the tubular 125.

At this stage the elevator 102 is released and the top drive 105 lowered to enable the tubular 125 to be connected to the string of tubulars in the slips and torqued appropriately by the top drive 105.

The pistons 117, 118 and cylinders 119, 120 are meantime extended so that after the tubular 125 has been connected the top drive 105 can be raised until the elevator 102

is immediately below the box. The elevator 102 is then actuated to grip the tubular 125 firmly. The top drive 105 is then raised to lift the tubular string sufficiently to enable the wedges in the slips to be withdrawn. The top drive 105 is then lower to the drilling platform, the slips applied, the elevator 102 raised for the tubular 125 and the process repeated.

CLAIMS

1. An apparatus for facilitating the connection of tubulars using a top drive and comprising a winch (15), at least one wire (4, 5), and a device (2) for gripping a tubular (3), the arrangement being such that, in use, the winch (15) can be used to winch said at least one wire (4, 5) and said device (2) to position a tubular (3) below said top drive.

2. An apparatus as claimed in Claim 1, further comprising a suspension unit (9) for coupling the tubular to the top drive.

3. An apparatus as claimed in Claim 2, wherein said suspension unit (9) has a static part fixed with respect to a top drive and a dynamic part movable relative thereto.

4. An apparatus as claimed in Claim 3, wherein said winch (15) is located on said static part of said suspension unit (9).

5. An apparatus as claimed in Claim 4, comprising a guide (7) located on said dynamic part (8) of said suspension unit (9).

6. An apparatus as claimed in Claim 5, comprising a pulley wheel (11) on said static part of said suspension unit (9).

7. A method of facilitating the connection of tubulars using a top drive and comprising the steps of attaching at least one wire to a tubular, the wire depending from

the top drive or from a component attached thereto, and winching the wire and the tubular upwards to a position beneath the top drive.

8. An apparatus for facilitating the connection of tubulars using a top drive, said apparatus comprising an elevator (102) and a pair of bails (103, 104), characterised in that said elevator (102) is, in use, movable relative to said pair of bails (103, 104).

9. An apparatus as claimed in Claim 8, wherein, in use, said elevator (102) is movable along said pair of bails (103, 104).

10. An apparatus as claimed in Claim 8 or 9, further comprising a piston (117, 118) and cylinder (119, 120) operatively connected between said pair of bails (103, 104) and said elevator (102).

11. An apparatus as claimed in Claim 10, wherein said piston (117, 118) and cylinder (119, 120) are pneumatically or hydraulically operable.

12. An apparatus as claimed in any of Claims 8 to 11, wherein said pair of bails (103, 104) comprise slots (116, 116a) in which pins (115) of said elevator (102) are arranged.

13. An apparatus as claimed in any of Claims 8 to 12, wherein said pair of bails (103, 104) are attached to a top drive on an axle (106) and are movable thereabout.

14. An apparatus as claimed in Claim 13, further comprising at least one piston and cylinder (108, 109) for moving said pair of bails (103, 104) and said axle (106).

15. A method for facilitating the connection of tubulars using a top drive, said method comprising the step of using an elevator to move a tubular to a position below said top drive, wherein the elevator depends from the top drive or from a component attached thereto.

16. A method according to Claim 15, wherein the elevator is connected to the top drive or to said component by way of a pair of bails, the method comprising the step of using said elevator to move said tubular in relation to said pair of bails towards or away from a tool for gripping said tubular.

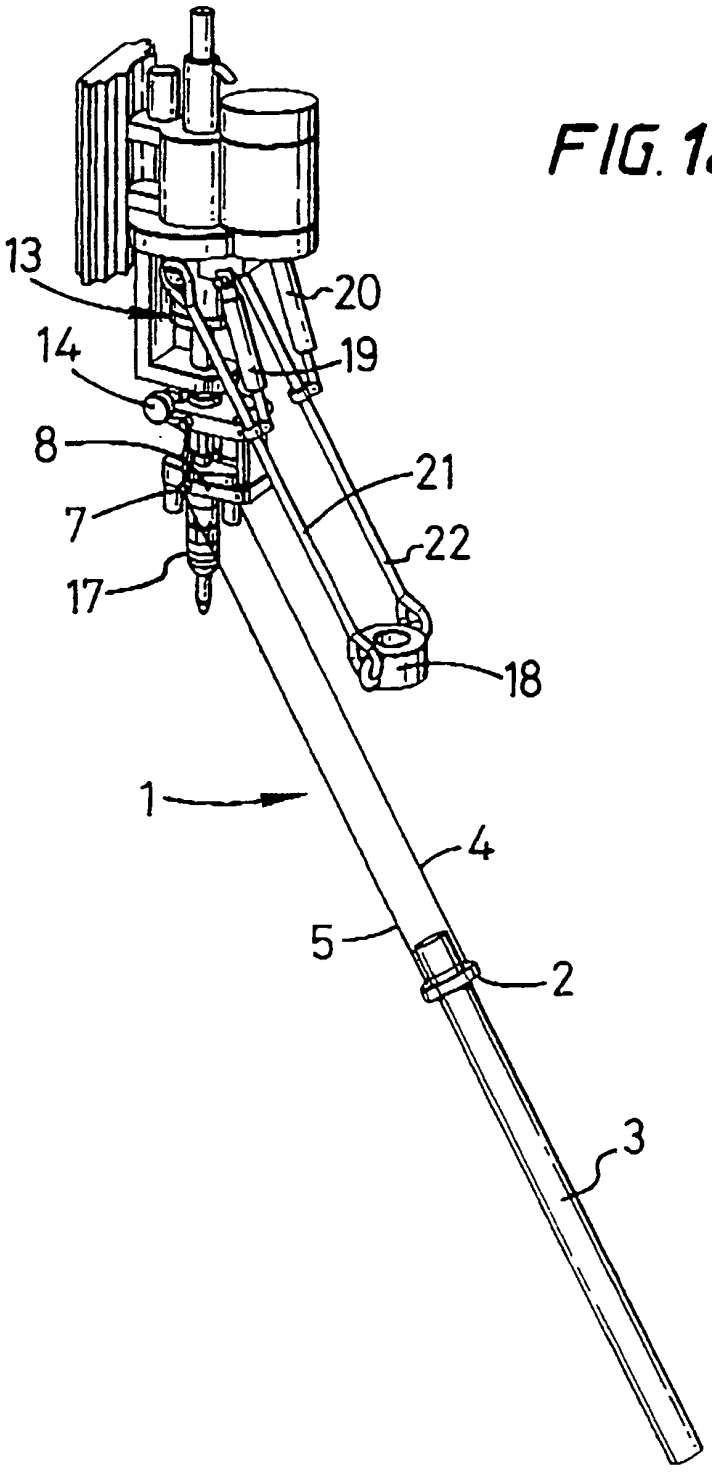

FIG. 1a

FIG. 1b

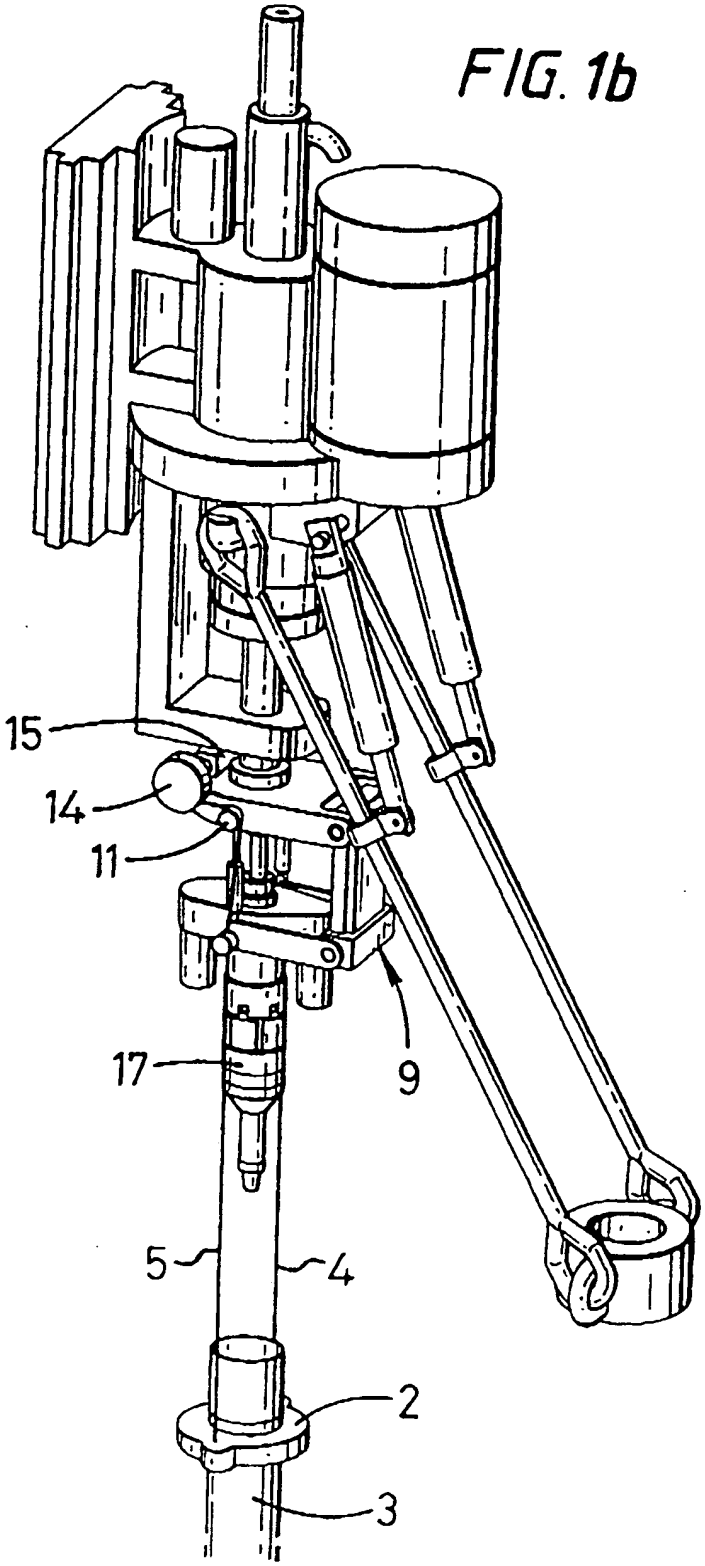

FIG. 1c

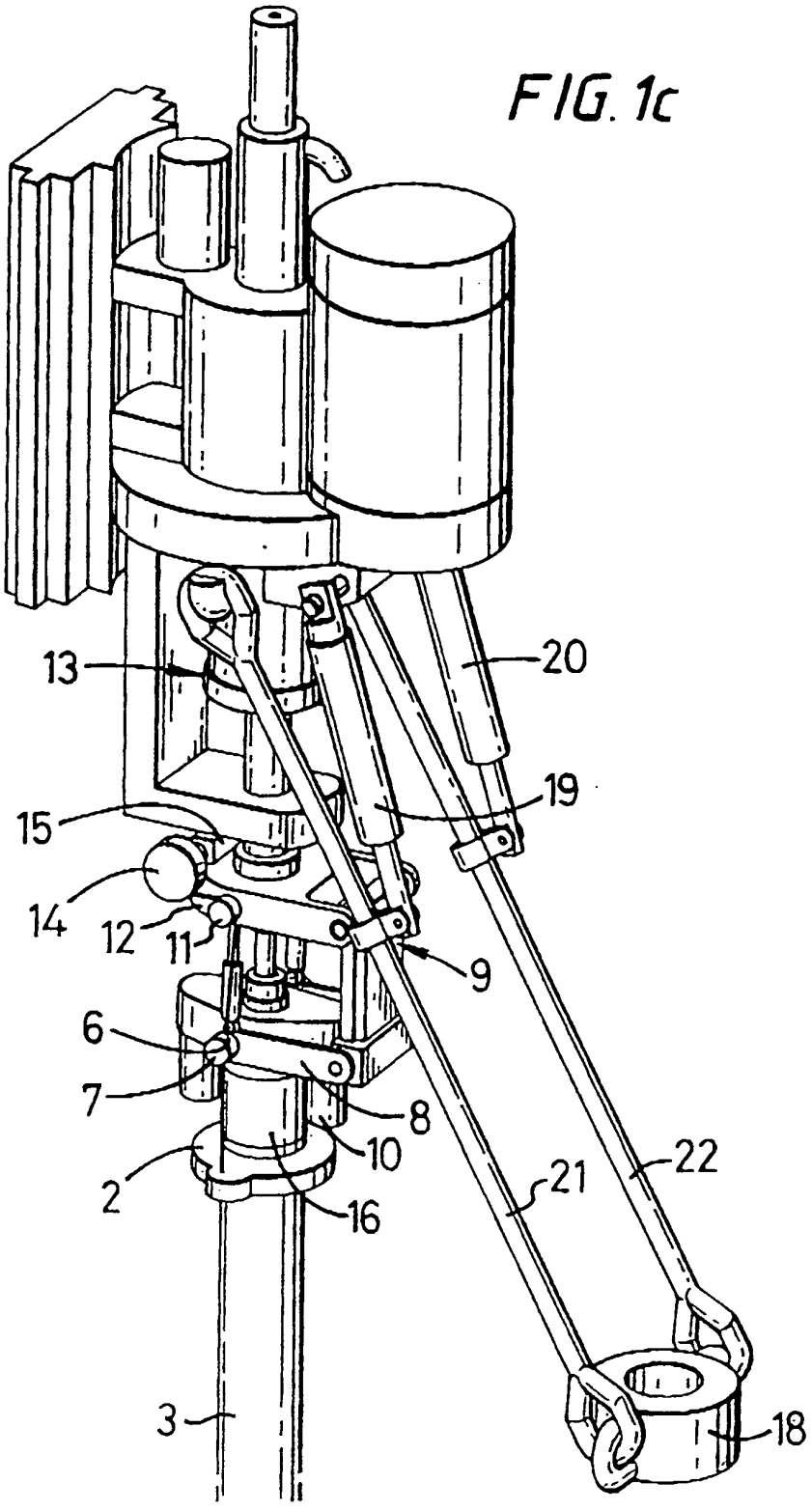

FIG. 1d

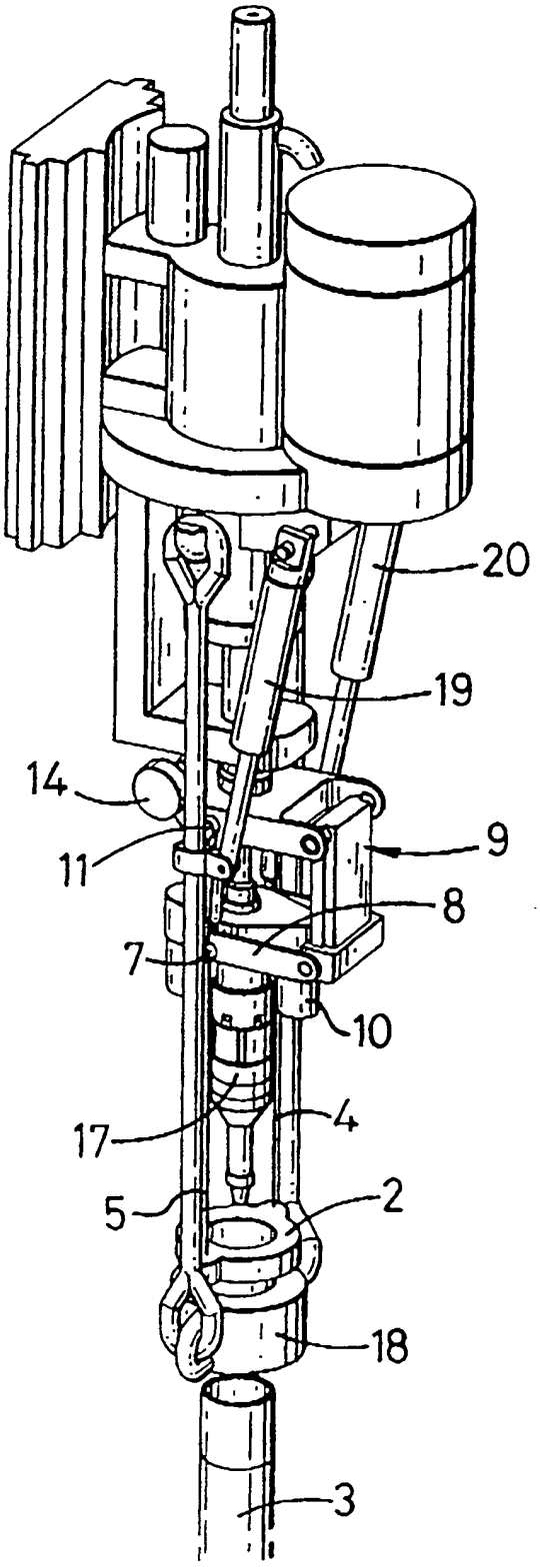

FIG. 1e

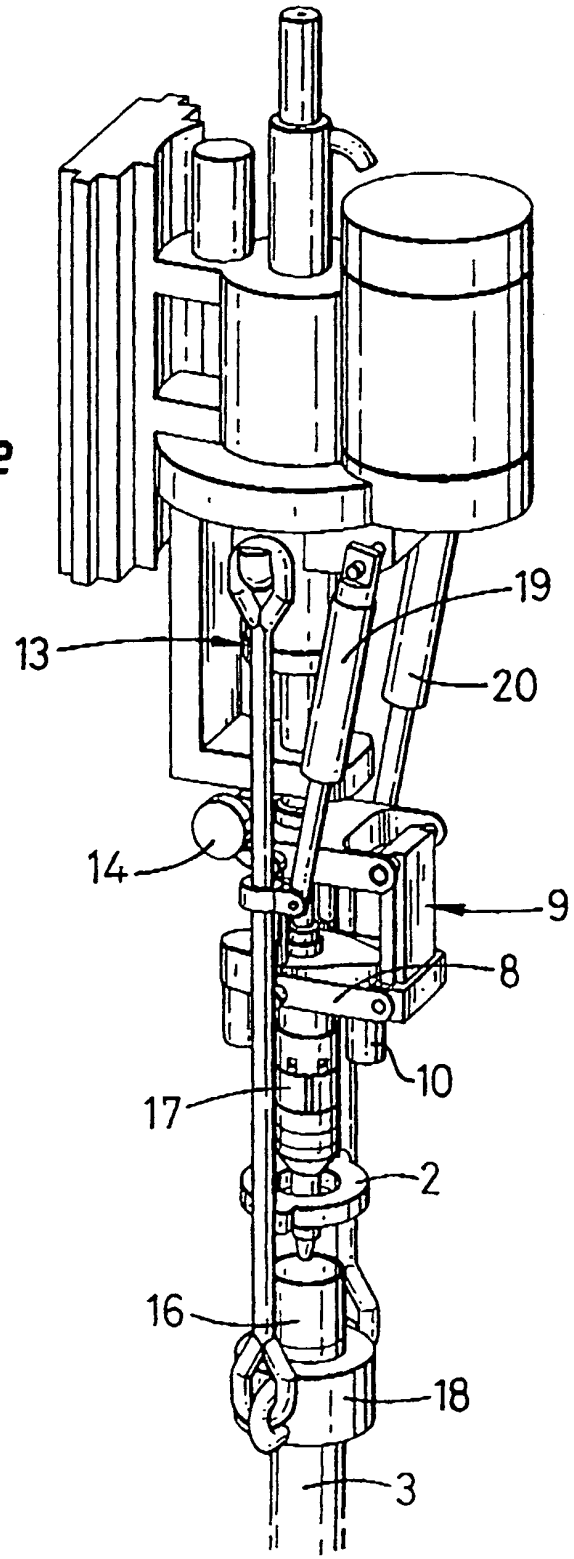

FIG. 2a

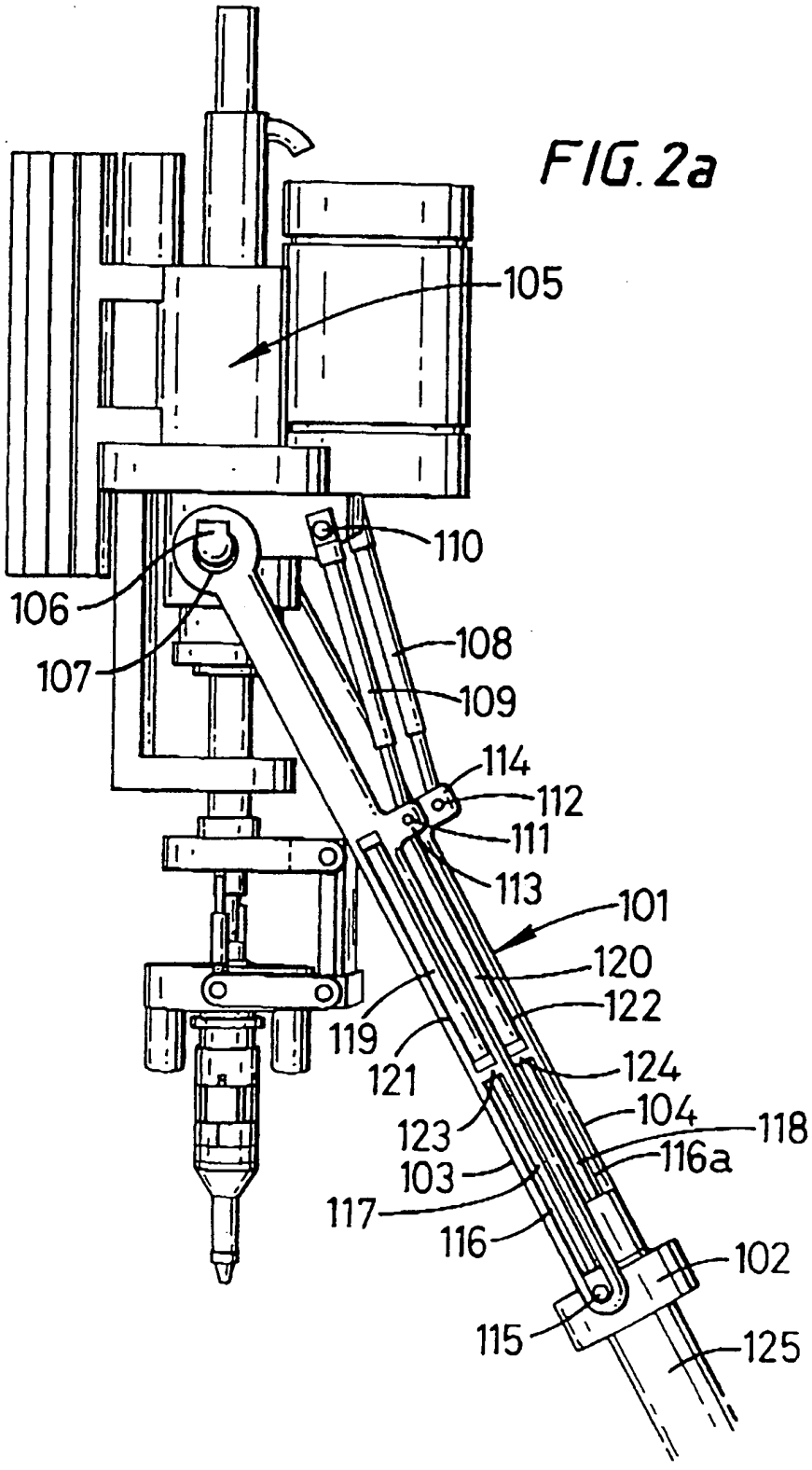
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FIG. 2b

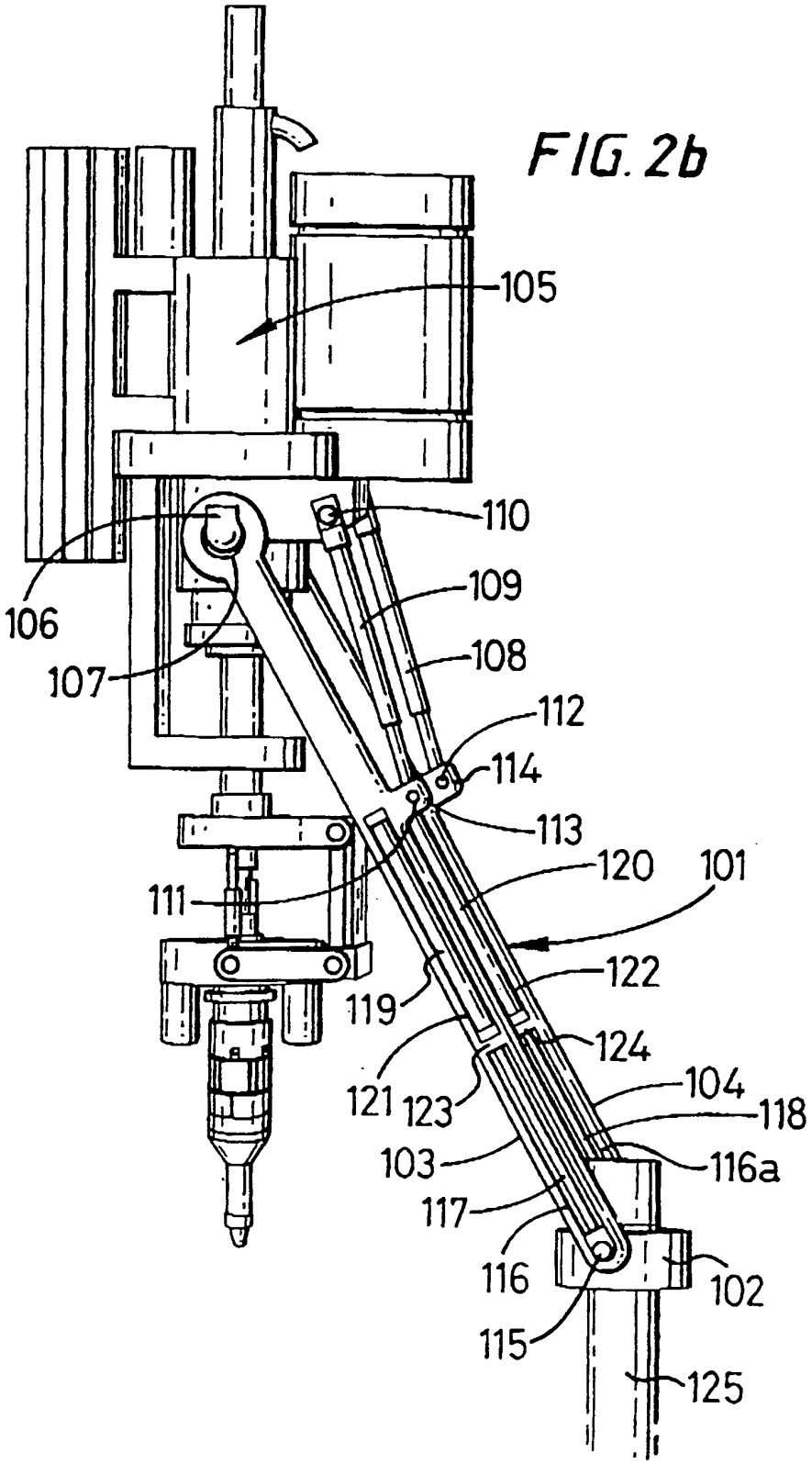
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FIG. 2c

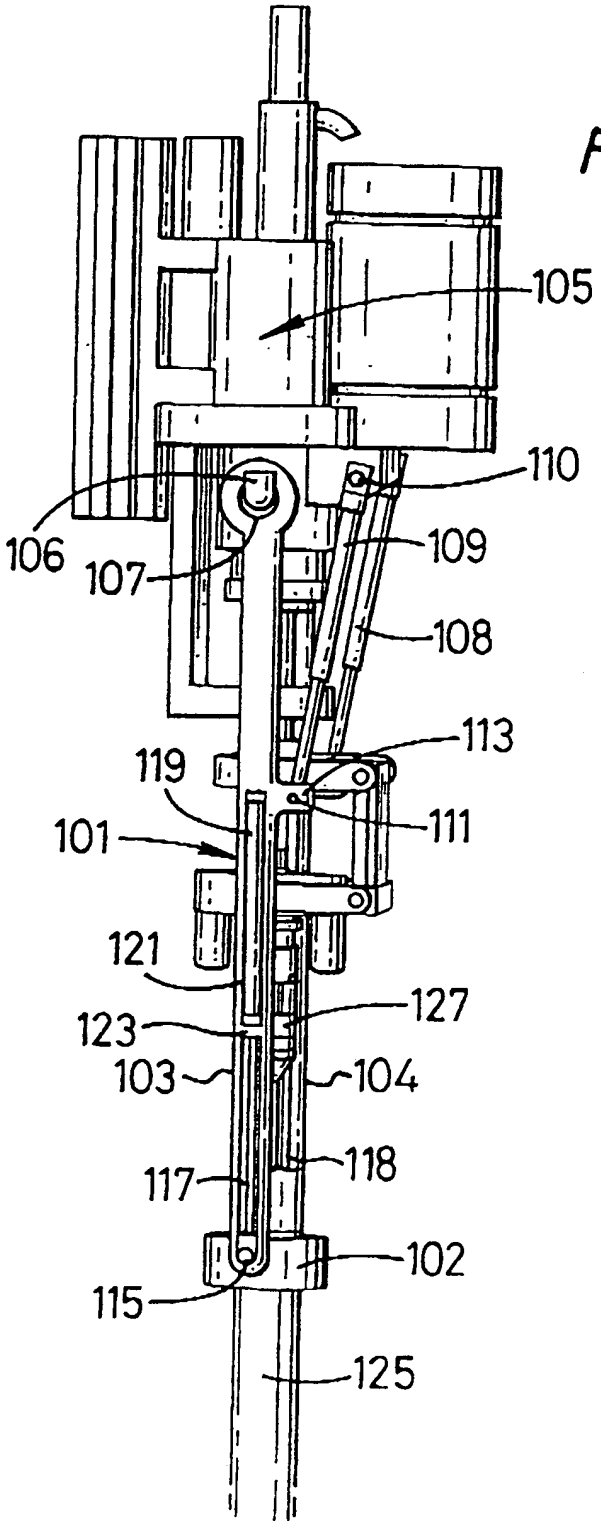
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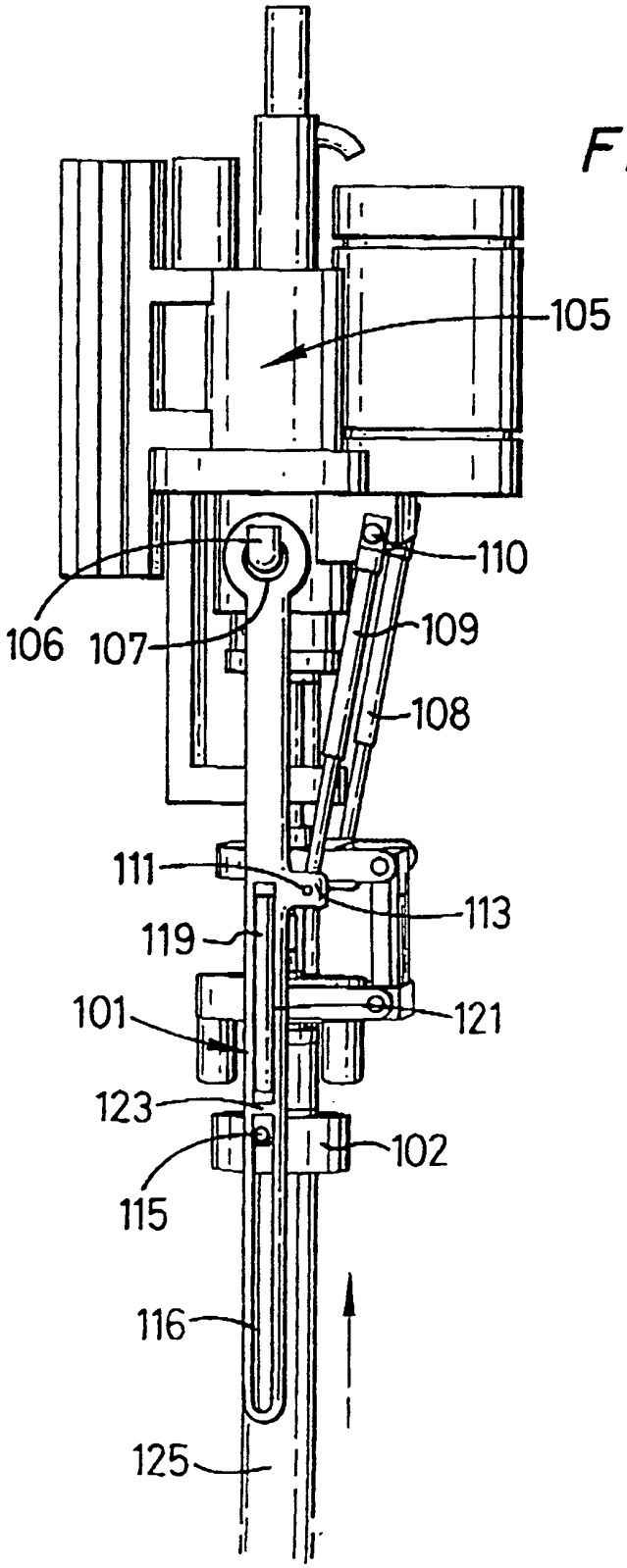
FIG. 2d



INTERNATIONAL SEARCH REPORT

Intern ıal Application No
PCT/GB 99/02704

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E21B19/16 E21B19/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 793 422 A (KRASNOV IGOR) 27 December 1988 (1988-12-27) column 2, line 20-22 figures 2-4	8,15,16
A	US 3 913 687 A (GYONGYOSI LASZLO ET AL) 21 October 1975 (1975-10-21) abstract figures 1-4	1,7
A	EP 0 171 144 A (WEATHERFORD US INC) 12 February 1986 (1986-02-12) figures 1-3	1,7
A	US 5 251 709 A (RICHARDSON ALLAN S) 12 October 1993 (1993-10-12) column 7, line 19-24 figure 4	8,15

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 November 1999	08/12/1999

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INTERNATIONAL SEARCH REPORT

Interr ıal Application No
PCT/GB 99/02704

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 857 450 A (GUIER W) 31 December 1974 (1974-12-31) column 7, line 1-3 figure 5A	8,15

1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 99/02704

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

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2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

...formation on patent family members

Interr ...nal Application No
PCT/GB 99/02704

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 3913687 A	21-10-1975	ZA 7500473 A	28-01-1976
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